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Presentation Outline
- Types of Diabetes
- Diagnostic Criteria
- Risk factors
- Obesity
- Importance of Pre-conceptual Care
- Physiology of Diabetes in Pregnancy
- Adverse Pregnancy Outcomes
- Fetal Programming/Epigenetics
- Treatment
- Importance of Postnatal Care
**Objectives**
- Describe the different screening methods for gestational diabetes
- Recognize the risks associated with obesity and hyperglycemia on pregnancy outcomes
- Identify the goals of pre-conceptual planning to improve pregnancy outcomes
- Describe treatment options
- Recognize the importance of Postpartum Follow-up on long term health outcomes

**Types of Diabetes**
- Type 1
- Type 2
- Gestational Diabetes

**Type 2**
- Primary Defect:
  - Insulin Resistance due to:
    - Overweight
    - Sedentary lifestyle
    - Food choices
    - PCOS

**Gestational Diabetes**
- Primary defect:
  - Insulin Resistance due to placental hormones
  - as well as:
    - Overweight/excess weight gain
    - Sedentary lifestyle
    - Ethnicity
    - Food choices
    - PCOS

**Type 1**
- Primary Defect:
  - Insulin Deficiency due to Beta cell failure

**Diagnostic Criteria**
### Type 1

- Hgb A1C 6.5% or >
- Random BS > 200
- Fasting BS > 126
- 2 h GTT > 200
- + antibodies

- Often present with:
  - + urine ketones
  - "3 Ps"
  - N/V, abdominal pain
  - Rapid onset → DKA

### Type 2

- Hgb A1C 6.5% or >
- Random BS > 200
- Fasting BS > 126
- 2 h GTT > 200

- Often present with:
  - Frequent infections
  - Poorly healing wounds
  - Blurry vision
  - Fatigue
  - "3 Ps"
  - Slow onset
  - Rarely DKA

### GDM Diagnostic Criteria

**GTT**

<table>
<thead>
<tr>
<th>ADA (2 h GTT)</th>
<th>ACOG (3h GTT)</th>
<th>C&amp;C (3h GTT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting</td>
<td>92</td>
<td>105</td>
</tr>
<tr>
<td>1 hour</td>
<td>180</td>
<td>190</td>
</tr>
<tr>
<td>2 hour</td>
<td>153</td>
<td>165</td>
</tr>
<tr>
<td>3 hour</td>
<td>X</td>
<td>145</td>
</tr>
</tbody>
</table>

### HAPO study

(Study included 25,000 participants in 15 centers and 9 countries)

**Primary Outcomes**
- Macrosomia
- Primary Cesarean Section
- Neonatal hypoglycemia
- Hyperinsulinemia

**Secondary Outcomes**
- Preterm birth
- Shoulder Dystocia
- Skinfold thickness > 90%
- Admission to NICU
- Hyperbilirubinemia
- Pre eclampsia

### GDM Diagnostic Criteria

**Screening:**
- 50 G(1h Glucola): 130 (90% specificity)
  140 (80% specificity)

Followed by 100G (3h GTT) if abnormal

### Gestational diabetes in the United States

- Using these new diagnostic criteria, a multicenter study of GDM found that 18% of the pregnancies were affected by gestational diabetes
- 15% of patients with GDM will require oral meds or insulin for sugar control
- Immediately after pregnancy, 5% to 10% of women with GDM are found to have diabetes, usually type 2.
- Women who have had GDM have a 35% to 60% chance of developing diabetes in the next 10–20 years.
In 2011, a study of more than 900,000 American women published in the American Journal of Obstetrics and Gynecology found:

- nearly 1/3 of pregnant women are **not** being screened by a simple laboratory test for gestational diabetes.
- 19% of women who were diagnosed with gestational diabetes were **not** screened for diabetes in the six months after giving birth (Getahun D, Nath C, Ananth CV, et al. Gestational diabetes in the United States: temporal trends 1989 through 2004. Am J Obstet Gynecol 2008;198:525.e1-525.e5)

**Risk Factors**

- **Type 2**
  - Insulin resistance
  - Obesity
  - Ethnicity
  - History of Gestational Diabetes
  - Sedentary Lifestyle
  - Family History of Type 2 DM

**Risk Factors (cont’d)**

- PCOS
- Age
- Large birth weight
- Medications (steroids, etc)

**Type 2 (cont’d)**

- Metabolic Syndrome
  - High blood pressure
  - Elevated triglycerides
  - Low HDL
  - Large waist circumference
  - Impaired glucose tolerance/elevated fasting glucose

- Gestational
  - Obesity/excess weight gain in pregnancy
  - Prior impaired glucose tolerance or GDM
  - Family History of Type 2
  - Age
  - Multiple gestation
  - PCOS
Obesity

Prevalence of Self-Reported Obesity Among Non-Hispanic Black Adults, by State and Territory, BRFSS, 2012-2014

Prevalence of Self-Reported Obesity Among Hispanic Adults, by State and Territory, BRFSS, 2012-2014

Why?

Prevalence of Self-Reported Obesity Among Non-Hispanic White Adults, by State, BRFSS, 2011-2013

The “Globesity” Crisis

% of overweight adult population

China Brazil Great Britain

25 30 35 40 45 50 55 60 65 70 75

Prevalence of Self-Reported Obesity Among Non-Hispanic White Adults, by State, BRFSS, 2011-2013

Prevalence of Self-Reported Obesity Among Hispanic Adults, by State and Territory, BRFSS, 2012-2014

Why?
Why?

Convenience

Food Cost

Portion Sizes

Sedentary Lifestyle
Walking the Dog

Why?

Diabetes and Obesity

BMI chart

Standard | Asian
---|---
< 18.5 | <18.5
18.5-24.9 | Healthy Range | 18.5-23.9
25.0-29.9 | Overweight | 24-26.9
>30 | Obese | > 27

Waist Circumference

Standard | Asian
---|---
Men | 40.0 in. | Men | 35.5 in.
Women | 36.0 in. | Women | 31.5 in.
BMI comparison Example

Caucasian: 5’ 6” 150 lbs = BMI 24.2

Asian: 5’ 2” 150 lbs = BMI 27.4

Diabetes is the leading cause of:

• kidney failure
• non-traumatic lower limb amputations
• new cases of blindness
• major cause of heart disease and stroke.

Diabetes in the U.S.

• Diabetes affects 29.1 million people:
  10% of the U.S. population (1 in 10)
• DIAGNOSED: 21 million people
• UNDIAGNOSED: 8.1 million people (1 in 4)

4.3 million aged 20-44: 2% of childbearing aged women with overt DM

Pre - diabetes

• 86 million Americans (20 yrs and older) with pre-diabetes: (1 in 3)
  90% of them don’t know it!!
• 44 million aged 20-44:
  9.5% of women of childbearing age

Diabetes is the seventh leading cause of death in the United States

Pre-conceptual Planning
Pre-conceptual planning

Obese patients

- 3-4 x more likely to develop GDM
- Increased risk of miscarriage
- Increased risk of congenital anomalies
- Increased risk of preterm delivery
- Increased risk of developing PIH
- Increased risk of macrosomia
- Increased risk of cesarean section
- Increased risk of postoperative complications

Adverse Pregnancy Outcomes Associated with Obesity

IOM Weight Gain Recommendations

<table>
<thead>
<tr>
<th>BMI</th>
<th>Total Wt Gain</th>
<th>Weekly Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
<td>28–40 lb</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5-24.9</td>
<td>25–35 lb</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0-29.9</td>
<td>15–25 lb</td>
</tr>
<tr>
<td>Obese</td>
<td>&gt; 30.0</td>
<td>11–20 lb</td>
</tr>
</tbody>
</table>

Pre-conceptual Planning

Diabetes: Type 1

- Education regarding pregnancy risks
- Important topic with adolescents for PNP’s!
- Monitoring other common co-morbidities such as:
  - Kidney disease
  - Thyroid disease
  - Retinopathy
  - Periodontal Disease
- Contraception

Pre-conceptual Planning

Diabetes: Type 2

- Education regarding pregnancy risks
- Monitoring other common co-morbidities such as
  - Obesity
  - Hypertension
  - Hyperlipidemia
  - Kidney disease
  - Retinopathy
  - Periodontal Disease
- Contraception

Glycemic goals

<table>
<thead>
<tr>
<th></th>
<th>Non-Pregnant</th>
<th>Pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA</td>
<td>&lt;7%</td>
<td>&lt;6%</td>
</tr>
<tr>
<td>AACE</td>
<td>&lt;6.5%</td>
<td>&lt;6%</td>
</tr>
<tr>
<td>Fasting</td>
<td>&lt;110</td>
<td>&lt;95</td>
</tr>
<tr>
<td>Postprandial</td>
<td>&lt;140</td>
<td>&lt;120</td>
</tr>
</tbody>
</table>

Glycemic control prior to pregnancy!
Hemoglobin A1C

<table>
<thead>
<tr>
<th>A1c (%)</th>
<th>g/dl (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>126</td>
</tr>
<tr>
<td>6.5</td>
<td>140</td>
</tr>
<tr>
<td>7</td>
<td>154</td>
</tr>
<tr>
<td>7.5</td>
<td>169</td>
</tr>
<tr>
<td>8</td>
<td>183</td>
</tr>
<tr>
<td>8.5</td>
<td>197</td>
</tr>
<tr>
<td>9</td>
<td>212</td>
</tr>
<tr>
<td>9.5</td>
<td>226</td>
</tr>
<tr>
<td>10</td>
<td>240</td>
</tr>
</tbody>
</table>

White Classification of DM

- Gestational diabetes
  - A1: Diet-controlled gestational diabetes
  - A2: Insulin-treated gestational diabetes

White Classification of DM

- A: Abnormal GTT before pregnancy at any age or of any duration treated only by diet therapy
- B: Onset at age 20 years or older and duration of less than 10 years
- C: Onset at age 10 to 19 years or duration of 10 to 19 years
- D: Onset before 10 years of age, duration over 20 years, benign retinopathy, or hypertension (not preeclampsia)

White Classification of DM

- R: Proliferative retinopathy or vitreous hemorrhage
- F: Nephropathy with over 500 mg/day proteinuria
- RF: Criteria for both classes R and F
- G: Many pregnancy failures
- H: Evidence of arteriosclerotic heart disease
- T: Prior renal transplantation

Physiology of Diabetes in Pregnancy

1. Mother’s blood brings extra glucose to the fetus
2. Fetus makes more insulin to handle extra glucose
3. Extra glucose gets stored as fat and fetus becomes larger than normal
**Physiology of Diabetes In Pregnancy**

hPL (human placental lactogen) antagonizes effects of insulin

Additionally, placental insulinase accelerates insulin degradation

Increased available glucose for fetus

hPL also promotes lipolysis as alternative fuel source

Mother is more prone to develop metabolic acidosis and infection

DKA is often severe and can lead to fetal death

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**Adverse Neonatal Outcomes Associated with GDM**

- Macrosomia (50% risk) → birth injury
- Neonatal Hypoglycemia
- Breathing problems
- Jaundice
- Preterm delivery
- Stillbirth

---

**Adverse Outcomes Associated with Pre-gestational Diabetes**

- Congenital Malformations
  - 3-5X greater than general population
  - 20-50% incidence if Hgb A1C > 8%
- Miscarriage

---

**Adverse Outcomes Associated with Pre-gestational Diabetes (cont’d)**

- Macrosomia (50% risk) → birth injury
- Neonatal hypoglycemia
- Breathing problems
- Jaundice
- Fetal Growth Abnormalities (IUGR)
- PIH
- Preterm delivery
- Stillbirth
Make a difference!
For every 1% increase in A1C prior to conception, risk of adverse outcomes increased by 5.5%.

Fetal Programming
Imbalance of:
- Food intake of macronutrients (fats, carbs, protein, etc)
- Deficiency of micronutrients (vitamins, minerals, etc)

= Chronic inflammation

- Inflammation is what has been identified as a pre-cursor for many diseases: diabetes, heart disease, cancer, etc.
- It is the collision of epigenetic changes that have occurred in combination with lifestyle changes: sedentary lifestyle, large portions, pesticides, hormones and highly processed foods that have resulted in dramatic increases in chronic disease.

Long term Outcomes of GDM/DM in Pregnancy
- Fetal programming
  - Obesity
  - Type 2 diabetes
- Learning disabilities

Fetal Programming
Genome: is our genetic program (DNA) -> genetically prone to certain diseases

Epigenetics: is the study of how we can affect the Epigenome— the signals— that switch on and off genes that can lead to illness or health.
Treatment of GDM (cont’d)

- Medications
  oral meds (glyburide/Metformin) or insulin
- Exercise
- Fetal Surveillance
- US for fetal growth, abdominal circumference
- Fetal monitoring
- Monitoring for pre-term labor and PIH

Treatment of Pregestational Diabetes

- Education
- Planned Pregnancies
- Early Identification (undiagnosed Type 2)
- Exercise
- Dietary Guidelines
- Weight Gain
- Monitoring
- Medications
- Fetal Surveillance

Treatment of GDM

- Diagnosis
- Education
- Risks
- Dietary modifications
- Self Monitoring Blood Glucose (SMBG)
  4X daily: fasting and 2 hours postprandial

Exercise
Monitoring
Self-Monitoring Blood Glucose

Monitoring
Continuous Glucose Monitors

Monitoring

Medications
Pregnancy and Lactation Labeling Final Rule (PLLR)
Effective June 30 2015 (replaces traditional: A, B, C, D, X)
Includes:
- Pregnancy
- Lactation
- Females and Males of Reproductive Potential

Allows better patient specific counseling and informed decision making, but does not provide definitive “yes” or “no”. Clinical interpretation is still required on case by case basis.

Medications
Insulin
Multiple Daily Injections
Medications

Insulin Pumps

Postpartum Education GDM
- Healthy Diet
- Medications: Oral/Insulin, BP meds
- Exercise
- Breastfeeding
- Weight Control
- Pre-conceptual planning for next pregnancy/Contraception

Maternal Complications
- Preterm Labor
- Polyhydramnios
- PIH and/or chronic HTN
- Cesarean Delivery
- Heart Disease
- DVT / Pulmonary Embolus
- Type 2 Diabetes postpartum (GDM)

Postpartum Follow-Up: GDM

**Negative GTT:**
- re-check Q 1-3 years
- Education
- Lifestyle
- Planned pregnancies
- Screening for prediabetes/Type 2 prior to next pregnancy

**Positive GTT:**
- pre-diabetes or Type 2 DM
- Education
- Lifestyle
- Medications
- Contraception
- Planned pregnancies

Diabetes Prevention Program
- The CDC-led program is an evidence-based lifestyle change program for preventing type 2 diabetes.
- The Diabetes Prevention Program research study showed that making modest behavior changes helped participants lose 5% to 7% of their body weight (that is 10 to 14 pounds for a 200-pound person).
- These lifestyle changes reduced the risk of developing type 2 diabetes by 58% in people with pre-diabetes.
Postpartum Follow-Up: Type 1
- F/u with endo/primary
- Hypoglycemia cautions with breastfeeding
- Adjust insulin doses
- Frequent Blood sugar checks/consider CGM
- Additional meds/dosage adjustment (levothyroxine/ ACE inhibitors)
- Contraception

Postpartum Follow-Up: Type 2
- F/u with endo/primary
- Hypoglycemia cautions with breastfeeding
- Consider Oral meds/GLP-1s/DPP-4 inhibitors/SGLT2 inhibitors vs. insulin
- Re-start other meds (statins, ACE inhibitors)
- Contraception

In Conclusion

Macrosomia
Fetal Programming
Childhood Obesity/Obesity
Diabetes as Young Adult/Adult
More Macrosomic Babies!!

Positive Outcomes

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